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Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Lubrication in the Baking Industry

Lubrication of Electric Railway Gears and Pinions

PUBLISHED MONTHLY BY
THE TEXAS COMPANY, U.S.A.
TEXACO PETROLEUM PRODUCTS

TEXACO LUBRICANTS *for* BAKING MACHINERY

A SUGGESTIVE LIST

giving recommendations for the various parts of the most commonly used types of machinery

Flour Handling Equipment:

Bearings and other Wearing Parts	*Ring or Chain Oiled*	Texaco Nabob Oil or Aleph
	Grease Lubrication—Pressure Type	Texaco No. 00 Grease
	Grease Lubrication—Compression Cup	Texaco No. 1 Grease
Chains and Gearing		Texaco Crater Comp. No. 1

Mixer:

Gearing		Texaco Crater Comp. No. 1
Chain Belt		Texaco Thuban Compound
Bearings:	*Ring or Chain Oiled*	Texaco Aleph Oil or Altair
	Grease Lubrication—Pressure Type	Texaco No. 00 Grease
	Grease Lubrication—Compression Cup	Texaco No. 1 Grease
	Roller Type	Texaco Petrolatum or No. 00 Grease

Divider, Rounder, Proofer, Moulder:

Bearings:	*Ring or Chain Oiled*	Texaco Nabob Oil or Aleph
	Grease Lubrication—Pressure Type	Texaco No. 00 Grease
	Grease Lubrication—Compression Cup	Texaco No. 1 Grease
	Roller Type	Texaco Petrolatum or No. 00 Grease
Gears, Chains, Cams, etc		Texaco Crater Comp. No. 1
Worm Reduction Gearing		Texaco Thuban Comp. "B"

Oven (Traveling Type):

Conveyor Chain Links, Roller and other parts subjected to high temperatures		Texaco Crater Comp. No. 1
Gearing		Texaco Crater Comp. No. 2
Bearings:	*Ring or Chain Oiled*	Texaco Aleph Oil or Altair

Oven (Rotary Type):

Worm Gearing		Texaco Thuban Comp. "B"
Bearings:	*Ring or Chain Oiled*	Texaco Aleph Oil
	Grease Lubrication—Pressure Type	Texaco No. 00 Grease
	Grease Lubrication—Compression Cup	Texaco No. 1 Grease

Wrapping Machinery:

General lubrication of all working parts		Texaco Nabob Oil
Bearings:	*Ring or Chain Oiled*	Texaco Nabob Oil or Aleph
	Grease Lubrication—Pressure Type	Texaco No. 00 Grease
	Grease Lubrication—Compression Cup	Texaco No. 1 Grease

Miscellaneous Equipment:

Steam Chests, Conveyors, Loading Devices, Cake Mixers, Pie Crimpers, Meringue Mixers, etc., Crumb Grinders, Cream Puff Fillers:

Bearings:	*Ring or Chain Oiled*	Texaco Nabob or Aleph
	Grease Lubrication—Pressure Type	Texaco No. 00 Grease
	Grease Lubrication—Compression Cup	Texaco No. 1 Grease
	Other Working Parts	Texaco Nabob or Aleph

NOTE: If the grade of oil to use for any specific part or machine is not covered in the above list, kindly call on us and we shall be glad to tell you the right oil to use.

If any of your machinery is operating under unusual conditions which require individual treatment, let us know the name of the manufacturer, the type of machine, the general operating conditions, and we shall be glad to advise you as to the right Texaco Lubricant which will give you the best possible service.

LUBRICATION

A Technical Publication Devoted to the Selection and Use of Lubricants

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Lubrication in the Baking Industry

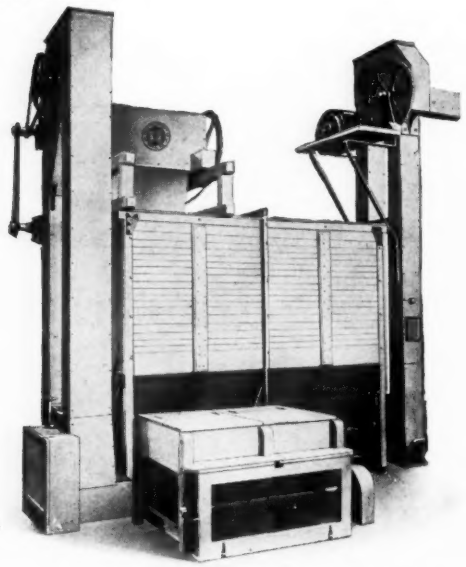
IN MANY industries today the purity or quality of the products depend to a marked extent upon the manner of lubrication and the grades of lubricants in use. Careless or sloppy application of the latter, or the use of inferior grades may frequently cause the ruination of otherwise perfect products due to spilling or dripping of the oil thereupon, as is the case in the textile mill. In no industry, however, does this concern us more vitally than in baking. The modern bakery, to successfully compete with the trade, must practically guarantee that its products are of the highest purity. To uphold this guarantee it must use only the finest grades of lubricants, applying same in the most careful manner to insure that they will not contaminate the bread, cake or pies in any way whatsoever. Proper application, however, is not alone a sufficient reason for neglecting to use the best oil possible, because notwithstanding the care in usage, there will ever be a possibility in certain processes of the oil coming in contact with the products. This would be particularly true with a poorly refined oil which might easily so discolor the dough or involve the presence of certain ingredients as to require the discard of the entire batch. In addition, the lubricants must be perfectly adapted to each process wherein used in order that the utmost economy and efficiency may be gained and the plant kept operating at maximum capacity.

From the crude mixtures of powdered wheat, salt and water that constituted the bread of biblical times, the development of the art of baking to its present-day efficient status is most interesting. More than any other specific food does bread constitute the diet of the average person today throughout the world. As an authority has remarked: Approximately one-third of the food of the American people consists of cereals—the cheapest diet known. The relative cost of such is in the neighborhood of one-tenth of the total cost of subsistence. Furthermore, three-fourths of this cereal is consumed as wheat bread, "The Staff of Life".

It may even be said that the extent of perfection in this art is more or less a direct measure of the state of civilization of the community. This is plainly indicated in our travels throughout the world, through observation of the crude "tortillas" or corn cakes of Central America, baked on an iron plate, the wheat flour "chappates" of India, baked on a griddle placed on coals, the "cassava" bread of the West Indies, the barley meal bread of Norway, and the oat cake of Scotland.

The development of baking machinery, whereby mechanical processes have supplanted manual labor in the modern bakery to a great extent, is most interesting. Only through such machinery is it possible today for our bread supply to meet the enormous demand. From the time the flour is received in the shop till the finished loaf of bread is ready for sale, practically all handling and every intermediate process is performed mechanically. Just as machinery has influenced the development of

the flour milling industry, as discussed in LUBRICATION for October, 1922, so has the allied trade of baking been expanded for the same reason.



Courtesy of Read Machinery Co.

Fig. 1.—Front View of a One-Floor Type of Flour Handling Outfit, showing details of construction. In this machine flour is dumped into variable feed bins and blended. It is then carried by the elevator and conveyor to a power cone sifter, for sifting and cleaning, being finally deposited in the storage bin.

Flour Handling Equipment

However thoroughly the flour may have been sifted and bolted in the mill, it should, nevertheless, undergo a secondary treatment in the bakery to remove lint bag shreds, or other impurities that may have gained access during packing, transit and handling. Therefore, it is passed through what is known as the cone sifter, or a bolting reel, or both. In general, the treatment that flour thus receives directly prior to becoming a part of the dough is: cleansing by sifting, blending to thoroughly mix the various grades that may be used, conveying to storage bins, and bolting. It can be appreciated that flour as dumped from sacks will be more or less lumpy and compact. Sifting and bolting breaks up the mass, thoroughly aerates the flour and renders the subsequent dough of that smooth, high quality necessary to permit of the finest grade of bread.

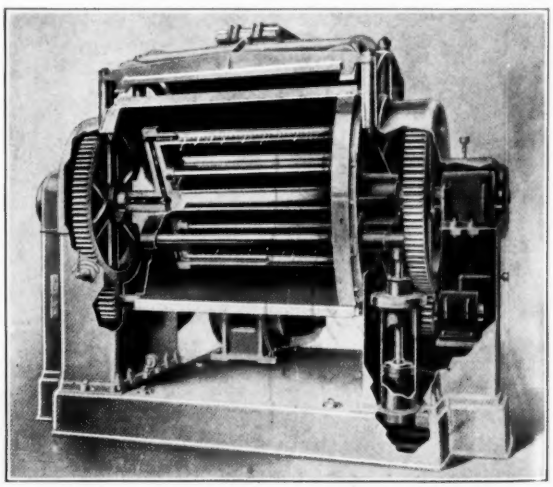
In usual construction flour handling equipment varies widely, though it is designed for the same general purposes, as mentioned above.

Lubrication

As a general rule, shafting and other wearing parts in flour handling equipment are built with special wood bearings requiring no lubrication. Where construction is otherwise, however, especially on internal bearings, they should be so designed that no lubricant can flow therefrom to contaminate the flour. On such apparatus the lubricant to use should be a medium viscosity oil of about 300″ Saybolt at 100° F., or else a light-bodied compression cup grease. On such gears and chains that may be installed for elevator drive purposes, a pure mineral gear lubricant of 1000″ Saybolt viscosity at 210° F. will be found satisfactory.

The Mixer

Perhaps the most universally used machine in the baking industry is the mixer; in fact, as an authority has stated, it is the veritable backbone of baking equipment, and is found even in the smallest shop. The mixer forms the first direct step in the preparation of the dough. Therein are mixed the flour and other necessary ingredients of the dough. These components, such as water, milk, yeast, salt, malt and shortening, may be either added directly to the main machine in measured quantities or



Courtesy of The Ecko Engineering Co.

Fig. 2.—Front View of a Typical High Speed Dough Mixer. Arm construction is clearly shown as well as operating mechanism. As generally operated all the mechanism is enclosed, both for protection of the operator and keeping the gears, etc. free from dust and dirt. This is a double arm type of machine.

mixed before-hand in a so-called ingredient mixer. This auxiliary is becoming popular in modern practice because the thorough preliminary mixing of these substances tends to a more uniform loaf of better texture. In addition, labor and time for mixing is materially reduced. Such a mixer is also used to advantage in dissolving yeast in water, mixing other yeast foods, pastry, sweet goods and custards, etc.

Speed in mixing is an important factor. Relatively high speeds, around 60 r.p.m., have superseded almost entirely today the old custom of using but a few r.p.m., it being claimed that thereby the mixture is more thorough, the gluten better developed and texture, color and absorption materially improved. Inasmuch as the fermentation period is also decreased by the use of a high speed machine, more of the desirable ingredients are retained and slacking is prevented. On the other hand, generated heat will be excessive unless some steps are taken to counteract this; therefore the procedure of blowing a steady current of cold, dry air into the mixture through the mixing arms, or otherwise, has been adopted. This air should be suitably filtered and washed to absolute purity, it being delivered by motor driven blowers at about 80° F. through sealed ducts. Other advantages that pertain to this process of air cooling are: the oxygen therein bleaches the dough, and yeast action is accelerated. The time required for mixing will vary from 8 to 15 minutes, depending on the type of machine used, and the grade of the flour. Naturally the lower the mixing period the greater will be the efficiency and rate of production; also the lower will be the power consumption per batch.

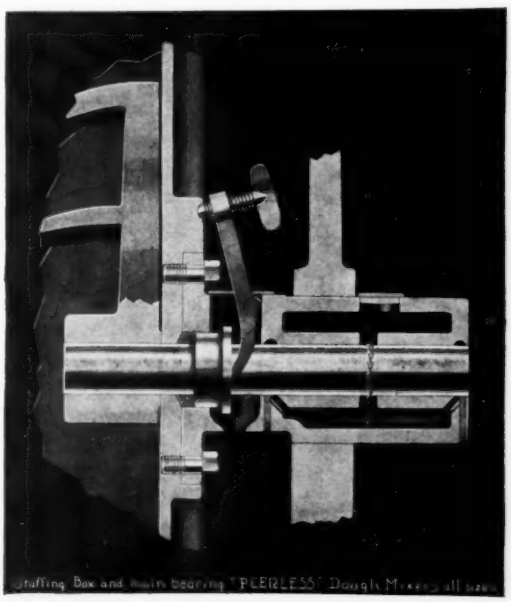
Actual construction of mixers differs chiefly in the arrangement of the arms, driving mechanism and tilting arrangement. The modern machine should embody the following features:

(a) The dough should be so rolled, pulled and stretched by the arms as to develop the gluten to the greatest extent, with no cutting or tearing.

(b) There should be no joints or bearings to come in contact with the dough, and axle bearings should be entirely separate from trough ends.

(c) Mixing arms should be designed (using hollow centers as some manufacturers advise) so that the dough will not wad thereupon but fall through easily.

(d) The machine should be self-cleaning and permit of no dry or unmixed ingredients to collect on the back of the mixing blades.



Courtesy of the Peerless Bread Machine Co.

Fig. 3.—Stuffing Box and Main Bearing on the Peerless Dough Mixer. By use of this type of construction easy renewal of packing is made possible, and there is no chance of lubricating oil getting into the mixing bowl or of salt water cutting out the main bearing.

(e) All driving and operating gearings, chains, etc., should be enclosed.

(f) The edge of the blades should act as a knife to keep the bowl scraped clean.

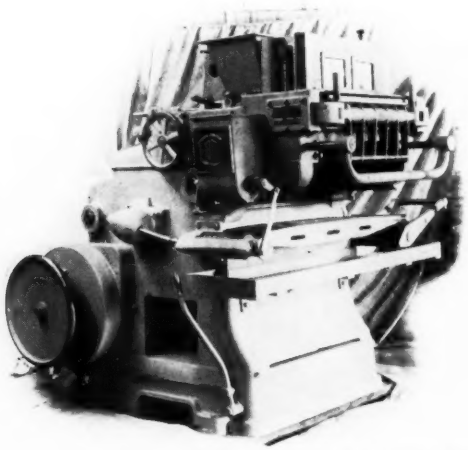
(g) Frame should be rigid; no vibration should occur; and entire operation should be smooth.

Lubrication

In the modern mixer lubrication will depend on constructional details. The larger machines are practically all of gear or silent chain drive, using electric power. Such mechanism is usually enclosed, as a safety factor, as well as to maintain freedom from dust, etc. Gearing is best lubricated by a pure petroleum product of a viscosity around 1,000″ Saybolt at 210° F. It must possess excellent adhesive properties and not drip or be thrown off by centrifugal

force. Hot application of this lubricant should be made by use of a brush.

Chain lubrication can be efficiently performed by use of a similar though lighter product, having a viscosity of about 200″ Saybolt at 210° F. In many cases, however, operators prefer to use a medium engine oil of 300″ viscosity at 100° F., feeding by means of a sight feed oil cup.



Courtesy of Joseph Baker Sons & Perkins Co., Inc.

Fig. 4.—A 6-Box Dough Divider. This machine is typical of the principle of feeding the dough into a hopper where it is periodically severed by a steel knife. The cut portion passes then into the cut-off box. From here suitable mechanism carries it to the dough pockets where actual division takes place. Lubrication of the Divider is an important point, due to the likelihood of oil coming in contact with the dough. The lubricant for such parts as the cutting mechanism and plungers must, therefore, be carefully selected.

For lubrication of bearings the chain or ring oiling system is prevalent and preferable, being far superior to grease cups. The latter will always involve the possibility of careless attention and subsequent damage to the bearings. The chain or ring oiler is positive in action and requires refilling of the reservoir only about every week or two, with complete cleaning about every three months. Its operation can always be observed from the top bearing oil hole, and maximum economy in oil consumption is obtained. Such bearings are subject to high pressure and require a fairly heavy, pure mineral engine oil of 300 to 500″ Saybolt viscosity at 100° F. When provisions are made for grease lubrication by means of compression grease cups, a good light-bodied cup grease will meet requirements. On motor bearings, which are practically always ring or chain oiled, the 300 viscosity engine oil is most advisable. Suitable stuffing box arrangement on the mixing arm shaft will prevent all possibility of oil entering through the main bearing to contaminate the dough.

If roller bearing construction is installed (as is the case on certain machines) a pure petroleum product of petrolatum nature, or a light-bodied compression cup grease will be suitable. Customary recommendations are to lubricate such bearings every six months.

Dividers

From the mixer, the dough in a modern bakery is usually delivered in bulk by gravity via a chute to the feed hopper of the divider. The purpose of this machine is to accurately divide the dough, scaling it to loaves of any desired size and weight without variation. It was soon proven in the development of the mechanical bakery that the old method of scaling loaves by hand was unsatisfactory and conducive to considerable loss due to overweight, especially under rushed conditions.

Construction of dividers varies, but in general embodies the same principles. In one very popular machine the dough as fed from the hopper is periodically severed by a steel knife, the cut portion being carried by gravity and suction into what is known as the cut-off box. Here, enclosed on all sides it is carried forward by a reciprocating piston to fill each of the rotating cylinder pockets with the desired quantity. The cylinder then automatically makes half a revolution, the dough in the pockets being cut cleanly from the mass contained in the cut-off box, and delivered to the working table or to suitable conveying apparatus for transmission to the rounder.

Another type of divider carries the dough from the hopper by a pair of adjustable rollers to a feeding chamber in which a reciprocating feeder operates. The dough is then pushed into a cylindrical plunger chamber at one side of the feed chamber by a cutter plate, and severed from the mass in the hopper. A plunger then carries the dough forward into one or more opposed chambers in a revolving measuring head.

Movable followers in the bottoms of these chambers eject the dough as measured. Desired weight of the loaves may be obtained without stopping the machine, by hand screw and worm adjustment to operate the followers exactly to the same extent. Mechanical operation of this machine is attained by gearing and suitable cam and connecting rod arrangements, electric driving power being used.

Courtesy of Jaburg Brothers, Inc.

Fig. 5.—An Improved Type of Ball Bearing Rounder. In this machine the dough is rounded in a natural manner on a flat surface. The capacity of this machine is 60 loaves per minute.

The various types of dividers today will require from one to three H. P. for operation, depending on their weight and capacity. Measuring devices may contain from one to six pockets, with a capacity of from 1,500 to 6,000 loaves of the usual weights per hour. Whatever the type of machine there should be no inaccessible crevices to retain dough till it becomes mouldy, or greases till they become rancid.

Lubrication

It is claimed by authorities that the modern divider is probably the most difficult machine to lubricate in the baking industry. Unless this be carried out most carefully, considerable power losses will result from too little lubrication, or oily bread from excessive usage. On all parts of the cutting mechanism, such as knife edge, plungers and back of the division box where there is possibility of the dough coming in actual contact with the lubricant, only the highest grades should be used, such as lard, cottonseed oil, lard compound or petrolatum or a non-tasting, colorless, pure mineral oil. No oil should be selected that has a tendency to turn rancid, gum, or react with sugar to affect the taste of the bread. For this reason petrolatum or a tasteless, pure mineral oil is considered as the more suitable.

Other working parts, such as bearings which are usually solid throughout with the exception of a roller bearing on the high speed motor shaft, can be well lubricated by an engine oil of about 300″ Saybolt viscosity at 100° F. Gears, chains or cam surfaces, require a heavier lubricant of petroleum nature, having a viscosity of about 1,000″ Saybolt at 210° F.

The Rounder

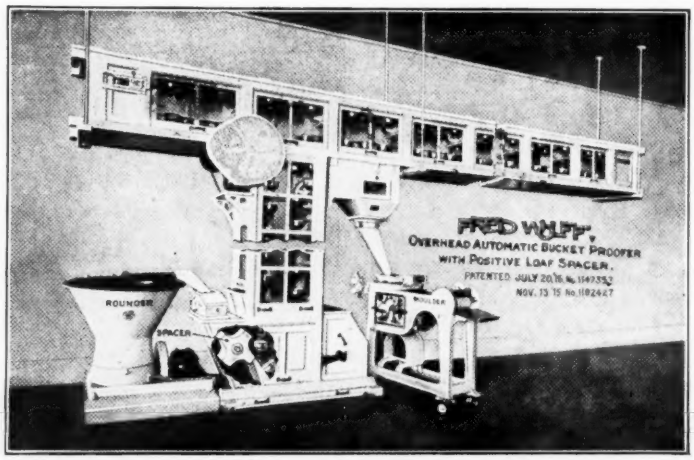
To simulate the action of the hand in rounding the pieces of dough and prevent the escape of gas from the cut ends, after they leave the divider they must be rolled or rounded-up. This is done in flour (or in the presence of air currents) to dry the surface or cause the formation of a protecting skin. When mother made her own bread this rolling process appeared to be just one of the little knacks pertinent to the baking of those great, luscious loaves we used to love as kids. The development of the rounder came as a logical sequence to the divider, for after dividing the dough automatically it was essential to have a machine that would quite as rapidly round or ball up the pieces and at the same time coat them with the required membranous covering. The modern rounder performs this most commonly (1) by the use of a kneading drum which scientifically rolls the pieces of dough around a conical shaped surface, or (2) the combination of a revolving conical table and spiral trough. Thus the loaves as received from the divider via traveling belt are rolled around in all directions to give them a perfectly spherical shape, and the cut ends completely balled up. Average operation will handle from 2,500 to 3,500 pieces of dough per hour on an up-to-date machine, with a power consumption of about one H. P. Usual practice subjects each loaf to a number of distinct operations. Thereby the surface of the dough is dried and given the desired covering, and little or no dusting flour is required prior to delivery to the proofer.

In conjunction with the rounder on certain designs, a suitable flour duster is installed with a regulator and delivery chute to control the rate at which the flour is used. A "flour catch" is also a necessary adjunct to prevent dusting flour from falling to the floor.

The average modern rounder will accommodate loaves of varying size with little adjustment. Some are even built to handle buns and rolls as well as full size loaves.

Lubrication

Rounder lubrication involves motor bearings, reduction gears, and spindle bearings. The first two points have been discussed under mixers, with recommendations as to suitable lubricants. Where worm reduction gearing is used, operating the gears in a bath of oil is generally best practice, using a pure petroleum lubricant of about 120″ Saybolt viscosity. Concerning spindle and other bearings: where ball or roller bearings are installed a good grade of petrolatum or a light bodied compression cup grease is the best lubricant. On other straight bearings the use of a pure mineral engine oil of about 300″ Saybolt viscosity at 100° F. applied by sight feed oil cups will be suitable. Certain smaller sleeve bearings may require lubrication by means of grease cups, wherein a light-bodied compression cup grease should be used.



Courtesy of Fred Wolff Millwrighting & Machine Co.

Fig. 6.—Typical Proofer Installation in conjunction with a Rounder, Spacer and Moulder. The relation of each machine to the other is clearly indicated.

The Proofer

After the dough has left the rounder it must be subjected to a period of "proofing" or "rest" prior to delivery to the moulder. This is commonly known as the preliminary proof and may take from 8 to 15 minutes as necessary. For this purpose there are various types of machines on the market, involving automatic bucket or belt conveyors, rotary motion, or simply stationary trays. In connection with the automatic bucket or belt proofer a spacer is commonly used, to deliver each loaf as received from the moulder to an individual container in the proofer. The spacer is simply a rotary compartment wheel, operating in connection with an incline built with drop bottom sections. These are set to open in sequence and deliver each contained loaf to a corresponding chamber on the traveling proofer conveyor. The loaves are then carried backward and forward by the conveying mechanism at such a speed that each will remain in the proofer the desired length of time, being then delivered by chute and hopper to the moulder.

Pan-Proofing

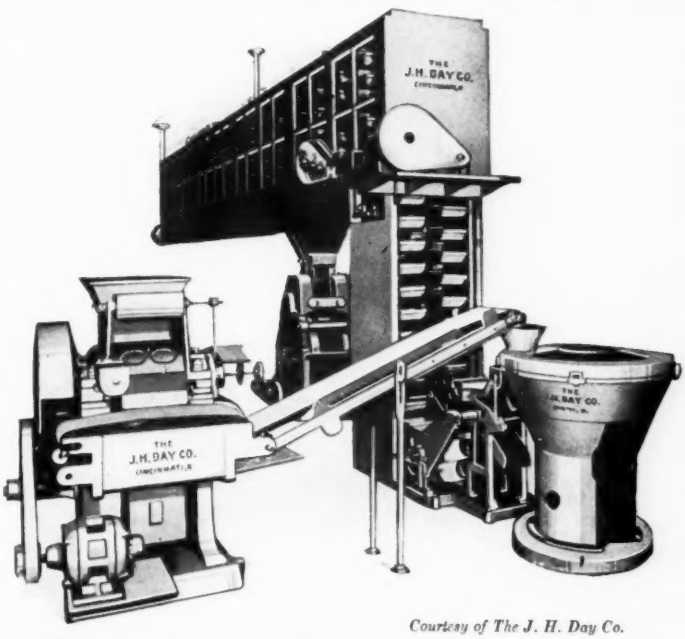
Dough must be subjected to a second period of proofing in the baking pans, after it leaves the moulder. To the layman this is known as the "rising" period. Pan-proofers (or steam chests as they are sometimes termed) are essentially wood or metal compartments, with shelves or conveyors installed for holding the pans, or built so that wheeled shelf carriers may be rolled in bodily. In pan-proofing the temperature is important. It must be maintained constant and the degree of humidity definitely controlled; otherwise the bread will crust abnormally or be inferior in appearance and texture. 90° F. is

considered as the proper temperature, with just enough humidity to prevent crusting. Under such conditions the desired proof is obtained in from 35 to 45 minutes. Heat and humidity are maintained by steam coils and with a water container in the base of the proofer.

Lubrication

There is no extensive lubrication necessary in the modern proofer. Pan-proofers normally require none. Only the automatic preliminary proofers concern us, and as these are usually built with wooden bearings for all conveyor rolls, only the motor bearings, the metallic bearings of the spacer and main driving mechanism, and reduction gearing, require lubrication.

Lubrication of motor bearings and gears has been discussed above. The other bearings are usually fitted for grease lubrication. On such service a light-bodied compression cup grease is suitable. Certain types of automatic proofers are equipped with roller or ball bearings on the main and auxiliary driving shafts. Lubrication in such instances is best attained by use of a pure grade of petrolatum or a light-bodied grease. Ball bearings are also used to some extent on revolving shelf proofers. Here as well, petrolatum or a light-bodied compression cup grease is the proper lubricant.



Courtesy of The J. H. Day Co.

Fig. 7.—Illustration to show the mechanical details of the automatic, overhead bucket proofer.

The Moulder

The process by which the loaf is given its final treatment and shaping prior to baking is performed by the moulder. It is generally conceded that this machine is the greatest money-saver in the trade, and a most important piece of mechanism. By its use each loaf is subjected to the same handling, the kneading pressure is uniform and exactly proportioned to the delicacy of the substance handled, and each is alike in shape and texture.

The steps involved are of interest. The loaf as it comes from the proofer passes into a feed hopper, being led to a series of rolls which flatten it, cause the escape of part of the gases and evenly distribute the remainder. This sheet of dough is then coiled in a spiral shape to whiten and aerate it, and also produce a uniform close grain. The coil then passes to a drum where it is kneaded and rolled, and a thin skin formed over the entire surface prior to discharge. Each piece of dough is in continuous motion throughout the machine, and there is no opportunity in a modern moulder for mangling or contact of any one piece with another. As installed today, these machines will vary extensively in construction, depending on the size of loaves or output required. Principles of operation, however, are alike in all.

Advantages over hand moulding are many, i. e.:

1. Far greater unit output; a mechanical moulder will mould with exact uniformity as high as 7,000 loaves per hour. Hand operation will average from 350 to 500 loaves per hour.

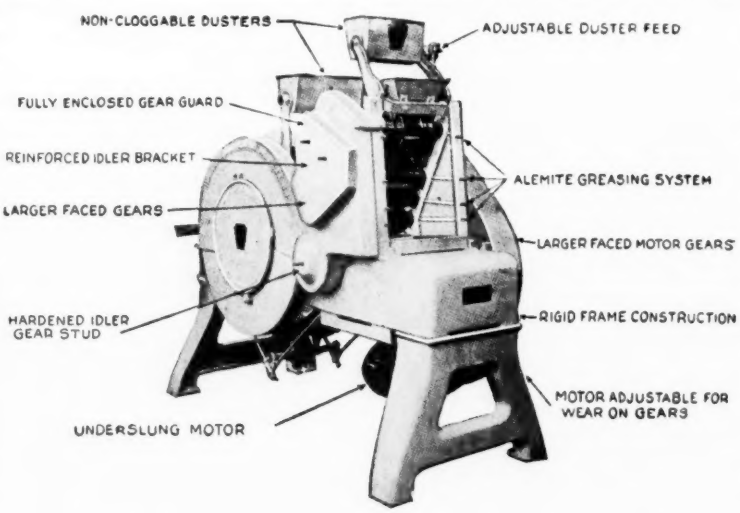
2. Fine dust in the air is eliminated, since the amount of dusting flour used is greatly reduced, or even rendered unnecessary in some

machines. Hence working conditions are far more healthful.

3. Worry as to whether the "baker's hands were clean" is eliminated.

4. Loaves are more uniform in size, and better shaped; and possibility of discolorations in the crumb or top crust on account of excess dusting flour is eliminated.

5. Manual labor in kneading and rolling is absent, hence the energy of the baker is conserved and he is able to use his best efforts in the operation of the machines to speed up output to a maximum.



Courtesy of Thompson Machine Co.

Fig. 8.—A Motor-Driven Loaf Moulder. The purpose of this machine is to prepare the loaf for the oven by flattening the dough to remove a certain portion of the gas, then kneading and forming it to thoroughly equalize the remaining gas throughout the mass.

Lubrication

Motor drive to rolls, via silent chains or belts, using suitable speed reduction mechanism is the most common construction in such apparatus. Gear and chain lubrication has been discussed heretofore under Dividers and Mixers. Bearing lubrication involves no special difficulties, such parts being so arranged as to entail little or no possibility of the lubricant contaminating the dough. It is common practice on bearings of this type to install grease cups, since they are relatively small and are usually not built with automatic oiling devices such as chains or rings. For this service a light-bodied compression cup grease is most suitable. Motor bearing lubrication has been discussed under Mixers.

The Oven

In the development of the art of baking from ancient crudeness to present-day efficiency, the story of the oven and its transition from prehistoric simplicity to modern perfection is interesting indeed. Since the stone age, through mediaeval times down to the present day the oven has been the basic element in baking. In the entire development of the industry, however, the oven has received but scant attention, and there are still in use today in remote localities, typical relics which differ very little from the old Roman types discovered in the ruins of Pompeii. Probably this is explainable by the fact that the baking industry has developed chiefly from a labor saving point of view. The divider, rounder, moulder and accessory handling equipment were all invented to speed up production. As a natural consequence the old ideas in oven construction and operation had to be superseded finally, though this did not occur till comparatively recently. Batch baking could no longer keep up with improved preliminary operations; nor could dough that had been scientifically and accurately prepared, be depended upon to maintain its weight and consistency, or receive the same extent of baking throughout.

As a result the modern automatic oven came to be developed. Many variations were tried out, some of which have received marked attention due to their being suited for certain classes of work. Of these the revolving oven is a typical example, as being admirably suited for the smaller bakery, though it does still involve the principle of baking by batches. For continuous operation, however, the automatic traveling oven is generally acknowledged to be the most efficient machine of its type in service today.

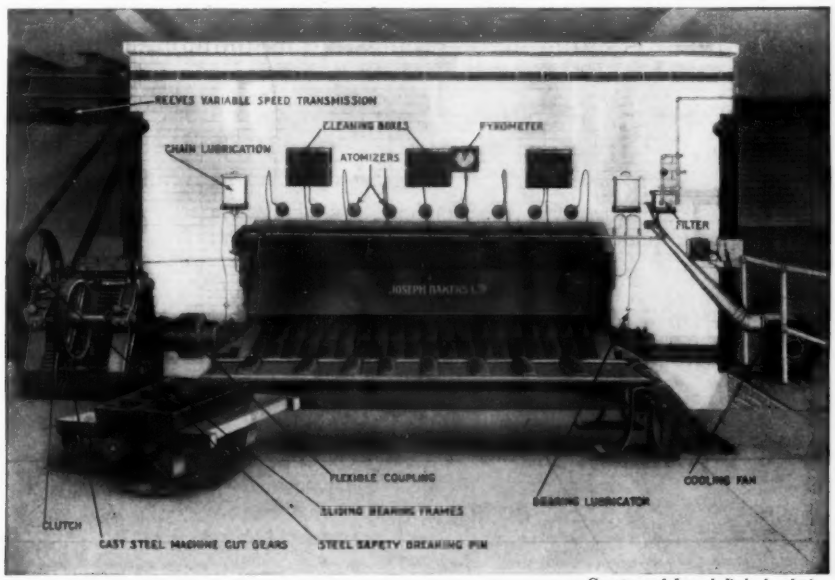
In general operation the loaves are fed in at one end onto an endless conveyor and carried at a slow uniform rate of speed through the baking chamber. Rate of conveyor travel is such that during this period the loaves are completely baked, being discharged automatically from the opposite end of the oven. The first loaf in is naturally the first out; therefore all remain in the oven practically the same length of time. Normally about 28 minutes is required to bake a 1-pound loaf, while 35 minutes is necessary for a 1½-pound loaf. On the other hand, baking time can be definitely regulated from 15 minutes to 75 minutes by suitable variable speed transmission gearing. Temperature at the beginning of baking is about 390° F., being controlled to gradually rise to about 450° F. in the center of the oven, dropping from then on back to 390° F. at the discharge end. Temperature control is accurately maintained and measured periodically by pyrometers at regular intervals along the oven. Speed of conveyor travel can be instantly regulated as desired to suit requirements.

As generally constructed, heat is supplied from furnaces located below the oven, in order to keep the oven room as free from dust and dirt as possible. The principle of hot air heating is used, suitable dampers being installed to regulate "top" and "bottom" heats as necessary. Due to the customary solidity in construction, the traveling oven is very economical in fuel consumed.

Lubrication

In the modern traveling oven lubrication is an important factor in the attaining of maximum efficiency. It can be readily appreciated that shutting down of the oven would absolutely terminate production over the period of shut down. Though the driving mechanism for the conveyor, and the component parts of this latter are rigid in construction, they require quite as much attention from a lubricating viewpoint as any other machinery in the bakery.

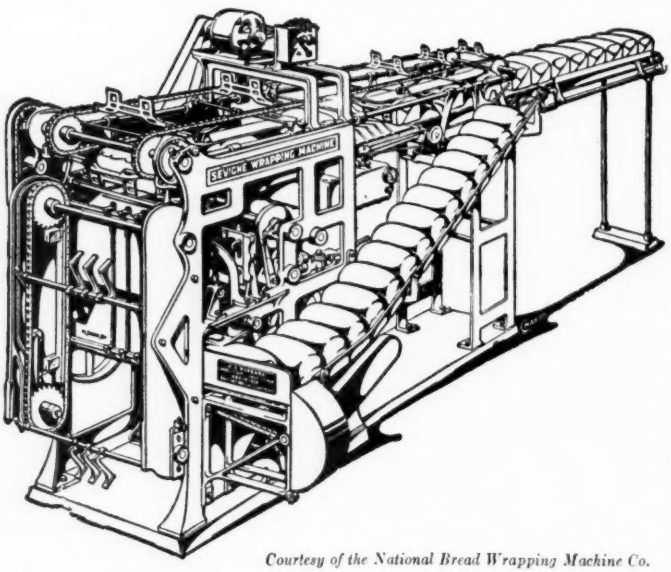
In operation conveyor chain links, rollers, bushings, and rods are subjected to most exacting service and normally are expected to run for indefinite periods without extensive repair. Of course, this can only be assured by proper lubrication. In general, lubrication of such parts is quite a problem due to the heats involved, and the usual grades of lubricants will



Courtesy of Joseph Baker's, Ltd.

Fig. 9.—The Delivery End of a Modern Traveling Oven. Details of construction are indicated by captions, and driving mechanism can be clearly noted. Perfectly baked bread comes continuously from the oven, each loaf having received exactly the same extent of baking.

not stand up for any length of time under these conditions. As a result there is a tendency of the operators to give the matter up as a hopeless job, and neglect oiling such parts entirely. For this service, all wearing parts exposed to oven temperatures should be lubricated with a relatively heavy mineral oil that will not undergo sufficient reduction in viscosity to drip or flow from the wearing parts. A viscosity of 1,000″ Saybolt at 210° F. would be adequate in usual service. Many engineers, however, prefer to use a mixture of graphite and light mineral oil. The latter will naturally evaporate rapidly, but the graphitic residue is claimed to work its way into the rolls quite effectively to insure proper lubrication.



Courtesy of the National Bread Wrapping Machine Co.

Fig. 10.—A Typical Modern Wrapping Machine. In this machine the bread is automatically received, wrapped, and the wrappers sealed with no manual labor except to maintain proper passage of the loaves at the receiving and discharge ends. The extension belt, shown at the extreme right, is devised to move more rapidly than the preceding carrying mechanism in order to expedite the prompt removal of the loaves and prevent backing up or any congestion.

Conveyor driving mechanism involves simply a problem of gear and bearing lubrication. Gearing is generally of exposed type, operated at relatively slow speeds. For this purpose a pure mineral gear oil of about 2,000″ Saybolt viscosity at 210° F. furnishes an excellent and most durable film of lubricant. Bearings for gear shafts, driving motor and conveyor sprockets are either of the chain or ring oiled type, or else of simple split bearing construction equipped with sight feed oil cups. In either case a medium-bodied engine oil of from 300 to 500″ Saybolt viscosity at 100° F. will be found quite suitable.

In the rotary or revolving type of automatic oven worm gear drive is customary. On such service a pure mineral oil having a viscosity of about 120″ Saybolt at 210° F. will be satisfactory. Other parts requiring lubrication such as bearings, etc., should receive the same oil as explained heretofore; or if grease lubrication is called for, a light-bodied compression cup grease will be suitable.

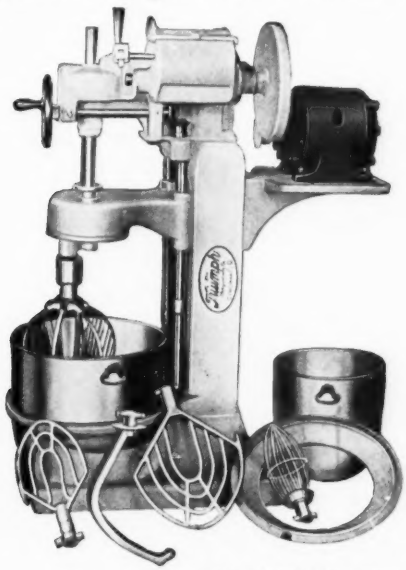
Wrapping Machinery

To conform to modern advances in sanitation and public health, it is becoming the practice today to have each loaf of bread suitably wrapped in an air-tight package to prevent entry of impurities and maintain its original freshness upon delivery to the customer. As a result, the automatic wrapping machine has been developed. By an ingenious arrangement of cams, reciprocating motion, chain and sprocket mechanisms and carrier belts the modern bread wrapper has been perfected to automatically receive, wrap, seal and deliver as high as 3,400 loaves per hour with normally no handling. Only sufficient manual labor is necessary to regulate feed and discharge at the desired rate, and lubricate the machine parts as required.

Lubrication

No especial problems are encountered in this respect on the modern bread wrapper. As usually designed it is constructed for oil cup lubrication with the exception (possibly) of the main drive and paper roll bearings, which may be equipped for grease lubrication. The oil to use for such service should be a relatively light-bodied, pure mineral product of 200″ Saybolt viscosity at 100°F. When a grease is

called for a light-bodied, low melting point compression cup grease will be found quite



Courtesy of The Triumph Manufacturing Co.

Fig. 11.—A 4-Speed Cake Mixer, Motor Driven. Extra parts for special purposes, such as wire whip, rubbing whips, and extra mixing bowl are shown below the machine. This machine may be used to mix bread or cake doughs, beat sponge cake icing and marshmallow, whip eggs or cream butter and sugar, as may be desired.

satisfactory. Whatever the means allowed for lubrication, a certain amount of care should be observed to insure against splash or dripping of excess lubricant onto the bread or wrapping paper.

Miscellaneous Equipment

Other appurtenances of the modern bakery, such as conveying apparatus for handling the loaves and specialty machines, including cake mixers, pie crimping machines, meringue mixers, etc., involve no specific lubricating problems. Where oiling is necessary, a good light-bodied compression cup grease, or medium viscosity pure mineral oil of 300″ Saybolt will be suitable.

Conclusion

In view of the importance that lubrication bears to the efficient operation of baking machinery, it can be readily appreciated that the utmost care should be observed both in the selection of the lubricant and in its actual application. The popular fallacy that an oil is "good enough" just because it apparently lubricates, must be discarded. As has been stated above, baking machinery involves the frequent possibility of contamination of the dough on account of dripped or leaked lubricants. The use of inferior, poorly refined, perhaps adulterated oils may easily result in the baker losing an entire batch of dough, or even becoming involved with the health authorities, to the certain detriment of his business. It will therefore be his best safeguard to use the same judgment in the selection of his lubricants as in the selection of his other working materials; and to apply them to his machinery with the same care as observed in mixing his dough ingredients.

Lubrication of Electric Railway Gears and Pinions

IN THE operation of the modern street railway, lubrication is quite generally accepted as one of the most vital factors governing the efficiency of the system as a whole. The care and judgment used in the selection and application of lubricants in this service practically governs whether operating and maintenance expense will fall within reasonable normal limits, or increase to an alarming extent. One of the most important phases of this problem is the lubrication of gears and pinions. Until recently this has received relatively little practical consideration for the purpose of determining a lubricant absolutely suited to the exacting conditions that must be met.

In the average trolley car, gears and pinions are subjected to unusually hard wear throughout, owing to the jerky operation at starting or in the changing of motors from series to parallel. This is especially true where rapid acceleration is desired. It can be appreciated that excessive wear, particularly on the teeth of such gearing, will tend to shorten the period of usefulness, and make expensive replacements necessary. In addition it will have a detrimental effect on the life of the armature bearings, especially on

the gear side. The effects on these bearings under such conditions also frequently result in

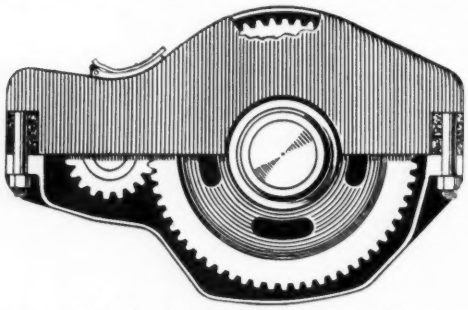


Fig. 1.—A typical electric railway gear arrangement. In general practice it is customary to feed the lubricant through the top gear case cover onto the gear and pinion teeth in the form of a plastic rope, while the car is moved slowly to revolve the gears.

serious damage to the armature and field windings. It can be readily seen that this problem is one of lubrication, and every effort should be made to use a lubricant for such service that will effectively insure against excessive wear, instead of endeavoring to discover a cure for the troubles after they have already started.

As a general rule the gear and pinion are enclosed by a metal gear case, the purpose of which is to retain the gear lubricant and to prevent the entry of any foreign matters such as dust, dirt, etc., which would tend to cause abnormal wear or interfere with perfect contact of the teeth.

On the other hand, operation with gears exposed, is sometimes found. Whatever the construction, however, the entire problem normally develops into the selection of the proper lubricant and its application. The prime requisites of such a lubricant are:

1. It should not harden nor contain any residual matter that is of a non-lubricating character.

2. It should possess marked adhesive properties in order not to drip or flow excessively under abnormal temperature rise nor be thrown off by the action of centrifugal force, or rubbed off under operation.

3. It should be of sufficient body to withstand the excessively high pressure at the point of contact of the teeth, and thereby prevent actual metal to metal friction occurring, whatever the season of the year.

4. It should be entirely free from acids or alkalis which would have a tendency to cause a certain amount of pitting on the highly polished metallic surfaces.

5. It should not be abnormally affected by heat or reacted upon by water, acid or alkali.

6. It should not tend to hold in suspension dirt and particles of worn metal, to produce an abrasive effect.

Other factors that should be considered in making this selection of the lubricant are: Ease of application; the amount required for the initial lubrication and for subsequent applications and the length of time it will efficiently lubricate without renewal.

A lubricant that will meet all of the foregoing requirements will without a doubt increase the life of gearing to a considerable extent and reduce the labor charges and other costs incidental to the maintenance of this type of equipment.

It is readily seen that the locality of operation and the maximum seasonal changes in temperature may have a great deal to do with the selection of the gear lubricant. It is of paramount necessity that uniform results be obtained throughout the year from such a lubricant. In order to meet this requirement it may be necessary, in certain localities of widely differing maximum and minimum temperatures, to use special grades of lubricants in accordance with the season, and temperature of operation. In other words, the ultimate aim should be that the viscosity of the lubricant in the gear case should remain approximately the same throughout the year.

Abnormal decrease in viscosity, or in other words, using a lubricant too thin for the service, would result in possible leakage from the gear case or undue splashing therein, or dripping from the gears (if exposed). On the other hand, using too heavy a lubricant would probably result in its settling on the bottom of the case in a semi-solid mass, the gears just cutting a channel through it, and running practically dry the while.

Experience has proven that the gear lubricant should have an approximate viscosity of 5,000″ Saybolt at 210° F. for normal summer service. For colder operation such as during the winter, the viscosity should be decreased to approximately 2,000″ Saybolt. Of course, special conditions may warrant the alteration of these figures.

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Why Trolley Cars Grind Their Teeth

OF COURSE trolley cars have teeth—gear teeth. And unless they are properly taken care of, trouble and expense follow.

Also, like human beings, about four out of every five suffer from lack of care—at least until someone learns the right way.

The chief reason for the premature wearing out of gear teeth is that they get the wrong kind of lubricant:—

A. One that is *too thin*
B. One that is ***too heavy***

The "A" kind leaks out of the gear box (which is never too tight after any amount of service), or is splashed around on the **inside** (and there is really no point to putting lubricant on the **walls** of the gear case).

The "B" kind drops to the bottom of the gear case and after a while the gears just cut a channel through it, and so run nearly dry.

And what is just as bad, such products hold in suspension dirt and particles of worn metal producing a very appreciable abrasive effect.

What's right then?

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Here's how it works—

A small quantity of TEXACO Crater Compound is put *directly* onto the uppermost gear teeth.

A few revolutions and *all* the teeth of all the gears are coated with a protective film of TEXACO Crater Compound.

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It doesn't fling around the casing.

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